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IN NEW ZEALAND**

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Three important factors determine the nutritional well-being of a country's inhabitants:

- A. Whether there is (a) enough food available of the right kind, and (b) containing all the necessary nutrient material;
- B. Whether its inhabitants can procure it; or can receive it if sick, etc.
- C. Whether their food habits and their knowledge of how to choose and prepare foods suitably, or adjust them to varying needs, can be designated as satisfactory.

Let us examine each of these factors in turn.

A. FOOD AVAILABILITY

(a) Food Production

The Dominion of New Zealand, part of the British Commonwealth, is 1,200 miles south-east of Australia. It consists of two principal islands, total area 100,000 square miles, stretching over a latitude of 35° to 47°S, *i.e.*, wholly within the temperate zone, but nowhere more than 100 miles from the sea. It is very mountainous, and, being situated largely within the "roaring forties", is subject to an uneven rainfall varying from 200 inches in some parts west of the main ranges to 10 inches in some parts east of them, but there is everywhere a good sunshine record, less intense in the south particularly in winter than in the north, a factor which plays a considerable part in production and population statistics. New Zealand can be said to "live by its grass", that is to say, it can feed animals such as sheep and cows outside all the year round. Consequently it is a primary producing country, with enough meat, butter, cheese, dried milk, apples, frozen peas, as well as a large amount of wool, to export. It grows the main quota of its own wheat and other cereals (some wheat is imported from Australia), while potatoes, vegetables and fruit are readily grown in most districts. Despite its situation in the Pacific Ocean, fish life is not abundant enough in the surface waters within easy distance of the shore to make fish plentiful. A little is however exported to Australia. The southern hemisphere is less well endowed with fish than the northern hemisphere, the conjecture being that phosphate and other nutrients are insufficient to sustain the requisite amount of plankton for supporting the fish life.

Production of food has been more than ample for the needs of the two million inhabitants. This production could not have been

maintained at a high enough level for export if it had not been enhanced by a great deal of research. The export of food and wool, etc., means the export of the nutrients that have been built into them. Of still more importance, rainfall being in general high, even more mineral nutrients are leached out of the soil and washed down into the rivers. To keep farm land in good condition, over three million hundredweight of fertilizer (chiefly phosphate) and over eleven million tons of lime are used in a year to top-dress grassland.

From 1926 onwards, there has been a Department of Scientific and Industrial Research, now with about forty divisions, of which about sixteen direct their efforts towards greater food production. (D.S.I.R. Handbook, 1960 edition, gives information about its organisation). The Department of Agriculture also has various research establishments. It can thus be said that there has been a great deal of study put into such items as soil deficiencies, improvement of pasture plants, and of cruciferous and other fodder plants, wheat breeding, animal husbandry, plant and animal diseases, and the many other adjuncts to good farming.

Latterly, there has been spectacular development of hill country through aerial top-dressing and seed sowing, combined with discoveries as to trace element deficiencies. The growth of grass on unploughable hills has rejuvenated much steep land that would otherwise suffer lamentably from erosion.

There is a great deal of farming educational activity going on—courses in agriculture at the agricultural colleges, young farmers' clubs, contact between the veterinarians and field officers of the Department of Agriculture and the farmer, all kinds of bulletins, e.g., on wheat growing, dairy husbandry, etc., regular journals such as the Journal of Agriculture and the Dairy Exporter, weekly articles in the papers and so on.

(b) Nutrient Materials in N.Z. Foods and Waters.

Animal and human health have both been affected by certain mineral deficiencies. Plant and animal ill-health from trace mineral deficiencies in the soil has impinged on the amount of produce exported rather than on human health. Trace element shortages that have led to diminished production in specified areas until explored and rectified have been numerous—boron, cobalt, copper, magnesium, molybdenum, sulphur, iodine, selenium. Wonderful results have been achieved by restoring the missing nutrient to the pastures, fodder or fruit-bearing lands, or to the animals. There is still much under investigation.

Shortage of two nutrients—both halogens—has led to widespread disorder of human health. Both of these disorders have been so common as to be accepted as part of the New Zealand scene, namely, deficiency of *iodine* and of *fluoride*.

(1) *Iodine and Goitre.* At the beginning of the forty-year period covered by this review, goitre was widespread. It had been recorded by the Medical Officer of Health for Canterbury in 1882 and was known to occur among the Maoris even before the advent of the Europeans. Sir Charles Hercus outlined the history of Thyroid Disease in New Zealand in the New Zealand Medical Journal, 45, 324-331, 1946, and in the 1952 Banting Memorial Lecture (Canad. Med. Assoc. J., 68, 531-537, 1953). The first survey he made on the incidence of goitre in 15,000 school children was in 1920 in Canterbury and Westland—32 per cent. had marked enlargement, a further 29 per cent. had thyroids sufficiently palpable and visible on deglutition to constitute pathological enlargement. The influence of puberty—80 per cent. in girls 12-18 years, and the higher incidence in athletic boys than in the less athletic were noted. In 1927, 68 per cent. of girls in a large factory in Christchurch had goitres.

Examination of military records for the 1914-1918 war revealed that a large number of recruits between the ages of 20 and 45 were declared unfit for active service on account of thyroid enlargement. The highest percentages were in the areas where the least iodine was found in the soil, thus Canterbury province with a soil iodine of 0.9 p.p.m. had 3.11 per cent. unfitted by goitre whereas Auckland (with soil iodine of 5.3 p.p.m.) had only 0.15 per cent. rejected from this cause.

A "goitre map" was drawn up showing areas with over 40% of school children affected by goitre.

There was no cretinism in the population, but there was much hyperthyroidism, enough to make people dread the prospect of developing it.

There was also goitre in animals—sheep, cattle, pigs, dogs and horses. The occurrence of large-scale outbreaks of goitre in lambs called for investigation and gave one profitable line of enquiry. The ewes had been wintered on swede roots, and when the lambs were born, they were unable to breathe because of atrophy of the trachea through pressure of enormous thyroid glands. The Brassicae family of plants later formed a starting point for seeking goitrogenic substances. However, meantime human studies progressed on groups that could be watched over a period, e.g., nurses, students and mental patients. As the administration of iodized salt reduced the size of simple goitres, iodization of salt was instituted in 1925, but only at the level of 1 part iodide in 250,000 parts of salt. However, its use was not sufficient to make a notable impression on the incidence, for many households used it merely on the table and not in cooking. Moreover, by 1934 researches had shown that excretion of iodide was much greater in the non-goitrous area of Samoa than in those receiving the salt iodized at the 1 in 250,000 level. An alteration in the amount to be added was obtained—against opposi-

tion from those who did not believe in the relationship between iodine and endemic goitre!—and thus, from 1939 onwards iodized salt for domestic use was available, but it has not been compulsory. Education of the population had formerly resulted in 1934 in only one-third of the uptake of iodized salt that there should have been. About 1941, more intensive advocacy of the use of the 1 in 20,000 iodized salt was instituted, and gradually it became evident that most of the sales of domestic salt in grocers' shops were of the iodized variety. Demand had altered the type stocked by the grocer. There were still some eddies in the stream of progress, however; for those accustomed to large-scale buying for institutions ordered salt without specifying "iodized" or without warning wholesalers to import large bags of it. Gradually, however, schools and hospitals have developed the habit of using it.

Only domestic salt has been iodized; commercial salt used for making bread, butter, canned goods, cheese, bacon, ham, corned meat, smoked fish, or sausages, has all been non-iodized. Of the total average daily intake of salt in New Zealand, *viz.*, 11 grams, bread and butter, etc., were found to provide about 5 grams, while the household salt contributed about 6 grams. These conditions were the determining factors in setting the legal amount at approximately 1 part in 20,000. As a corollary, addition of iodine compounds to other foods is prohibited.

The effect of this new level, coupled with patient education, resulted in a telling decline in the incidence of goitre in school children. The 1938 figure for all types of goitre in school children averaged for the whole of New Zealand (which has some non-goitrous areas) was 15.1 per cent., while by 1953 it was 1.1 per cent. The fall was steady, and the goitres that were so evident in all adolescent girls in some areas, are no longer seen.

A survey of school children by Tolley recorded in the Annual Report of the Director General of Health for 1951 compared findings for one sea-coast town with earlier records in the 1920's for that town.

We are aware that "the price of freedom"—from goitre—"is eternal vigilance", and we continue to keep advocacy of iodized salt to the forefront of teaching in schools, and in the education of nurses (see section in *Normal Nutrition*—Notes for Nurses, 1960, by the author). We also warn of the danger of uncontrolled medication, and for that reason we have not permitted the use of iodate in the new technological process for bread-making (*i.e.*, the continuous process), for it is calculated that the average intake would be of the order of 2.6 milligrams iodine element per day, an amount too high when it is thought better not to exceed 300 micrograms as the daily intake in goitrous areas.

It should be stated that seaweed has not been a common article of diet in New Zealand, but that in the search for preventive

measures, carageen was used before the 1 in 20,000 iodization level was achieved, and it is still used *e.g.*, for pregnant women on low-salt intakes—when salt is excluded from the diet. We emphasise the importance of iodide during the period of pregnancy for prevention of goitre in the child. We also are aware of the need of the child during the preschool period, for in the studies on goitre incidence in the 1920's, 30 per cent. of preschool children already had goitre when they came to school.

It should be further remarked that it is a fallacy to believe that being near the sea is a protection against goitre; sea air cannot supply more than 2-3 micrograms of iodine daily. Sea water contains only 20 micrograms per litre. Fishes vary in their iodine content, only those that feed on seaweeds (which concentrate the iodine) are worthwhile contributors of iodine to the diet. Fish is however an expensive commodity in New Zealand, and is not regularly available in country districts.

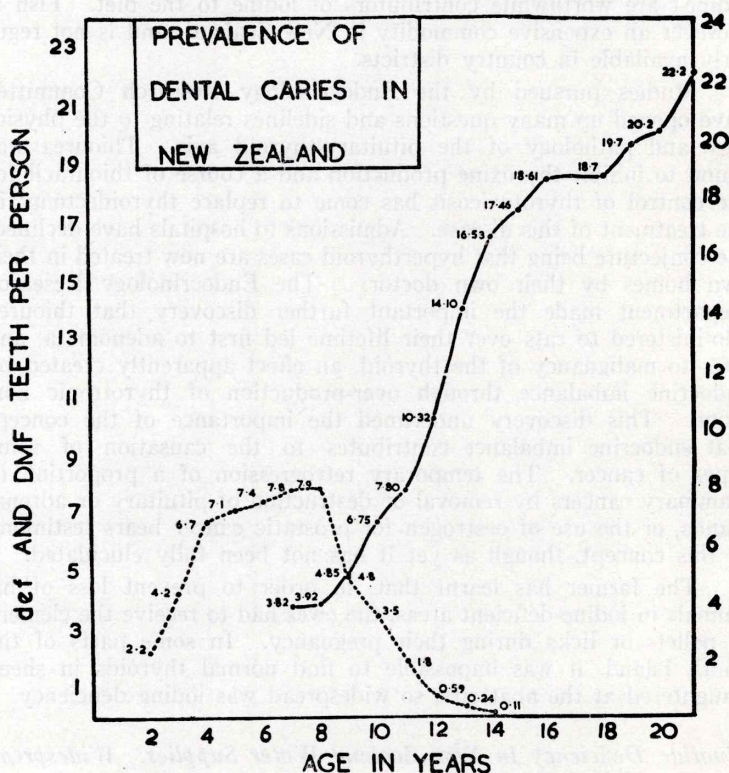
Studies pursued by the Endocrinology Research Committee have opened up many questions and sidelines relating to the physiology and pathology of the pituitary-thyroid axis. Thiourea was found to inhibit thyroxine production and a course of thiouracil for the control of thyrotoxicosis has come to replace thyroidectomy in the treatment of this disease. Admissions to hospitals have declined, the conjecture being that hyperthyroid cases are now treated in their own homes by their own doctor. The Endocrinology Research Department made the important further discovery that thiourea administered to rats over their lifetime led first to adenomata, and later to malignancy of the thyroid, an effect apparently created by endocrine imbalance through over-production of thyrotropic hormone. This discovery underlined the importance of the concept that endocrine imbalance contributes to the causation of some types of cancer. The temporary retrogression of a proportion of mammary cancers by removal or destruction of pituitary or adrenal glands, or the use of oestrogen for prostatic cancer bears testimony to this concept, though as yet it has not been fully elucidated.

The farmer has learnt that, in order to prevent loss of his animals in iodine-deficient areas, the ewes had to receive the element in pellets or licks during their pregnancy. In some parts of the South Island, it was impossible to find normal thyroids in sheep slaughtered at the abattoirs, so widespread was iodine deficiency.

Fluoride Deficiency in New Zealand Water Supplies. Widespread Dental Decay

In New Zealand, the fluoride content of potable water supplies is well below one part per million (G. Chamberlain, N.Z.J. Sci. & Technol. 26B, 90, 1944; *ibid.* 28B, 1946; Denmead, C. F., *ibid.* 28B, 158, 1946).

The dental health problem has been reviewed in the Report of the Commission of Inquiry into the Fluoridation of Public Water Supplies. (Government Printer, 1957). "Gross dental decay and the use of artificial teeth are so common amongst persons born in New Zealand that this departure from a state of health is regarded by some persons almost as if it were a normal state of health." "Virtually every child born in New Zealand experiences dental decay." The incidence in deciduous and in permanent teeth is shown in the graph below depicting that the decayed, missing and filled (DMF) rate rises to an average of 22 in young army recruits, artificial dentures being worn or required by about 30 per cent. of these young men.



def = decayed, extracted and filled deciduous teeth
DMF = decayed, missing and filled permanent teeth

The high intake of sticky types of carbohydrate foods is a contributing factor to the dental decay depicted above.

A scheme for a two-year training period for girls to qualify as school dental nurses was first instituted in the early twenties. The aim of this National Dental Service is to prevent dental disease on a national basis, free treatment being now given to children from 2½ years of age and to adolescents up to 16 years of age. The annual cost is over £1,500,000. Educational work is also done by the dental nurse. There are however too few dentists and dental nurses to cope with the fillings and extractions that are required. Dental decay is thus a major problem in public health, and a matter for grave concern.

The fluoride content of New Zealand teeth is exceedingly low. (Marion F. Harrison. University Thesis, 1945; Harrison & Bell, *N.Z. Dent.J.*, 43 5-34, 1947; Harrison, M. F., *N.Z. Dent.J.*, 45, 2-27, 1949). This finding confirmed the suspicion held by one of the authors (M.E.B.) ever since she had told her 1926 and 1927 dentistry students of the finding by McCollum et al, (*J. Biol. Chem.* 63, 553-562, 1925) that the teeth of rats were harder when fluoride was added to their diet. It became clear to these authors that fluoride should be tried as a preventive measure for New Zealand children's teeth. This was publicly advocated at the Conference of the New Zealand Institute of Chemistry (1945), and the Conference of the New Zealand Dental Association, 1946; and to the Christchurch Branch of that Association in 1946. To the public, the subject had first been opened in two articles to the New Zealand Listener in August, 1944, by Bell, who had also put it forward to the Director-General of Health. As no move was made elsewhere, the Nutrition Research Department decided to issue fluoride solutions to those who showed an interest in protecting their children's teeth from decay. There were hence a few individual families using fluoride from 1944 onwards. The more convenient method of distributing fluoride tablets was later adopted.

Here and there a dentist with an appreciation of the prophylactic value of fluoride aroused the interest of local councillors, who thereupon sought permission to add fluoride to their water supplies. The Papakura Borough Council wrote to the Minister of Health in 1947, but was refused permission to try out the addition of fluoride to their water supply, as it was considered preferable to await the results of the experiments being conducted in United States of America, and as Papakura was deemed not to have sufficient population for the purpose of a trial.

By 1952, however, Hastings had obtained permission to use its water-supply as a vehicle for fluoride. The Department of Health financed and controlled the procedure, deciding through the Dental Research Officer of the Medical Research Council to use Napier, which had a water supply of similar origin, as a non-fluoridated town for comparison. Opposition from a group there has however been experienced. Meanwhile, proponents of fluoridation had formed

societies such as the Fluoridation Society in Auckland. In 1956, it was decided by the Government to appoint a Commission of Inquiry, who came to the conclusion that "The fluoridation of public water supplies in New Zealand would be followed by substantial benefits to dental health" and that "widespread use should be made of the fluoridation process."

By 1959, 4½ years of fluoridation at Hastings had produced a spectacular reduction of dental caries in young children. This and other progress has been recorded by G. N. Davies in *J. of Assn. of Home Science Alumnae*, 28, 1959, 6-9. Nevertheless, opponents called for referenda in eight municipal electorates in 1959; all majorities were against fluoridation, the votes in favour ranging from 26.5 to 43.7 per cent.

An analysis of the reasons for the attitudes of voters was made through a questionnaire and published by Austin Mitchell (*Fluoridation in Dunedin—A Study of Pressure Groups and Public Opinion, Political Science*, 12, 71-93, 1960), "...it was difficult to persuade people of the necessity of a measure, the benefits of which were not immediate and obvious, and...it was easier for opponents to place doubts in the public mind than it was for supporters to remove them."

Iron intake among "vulnerable" groups is often marginal in any community unless specific measures are taken to prevent it. This subject will receive attention when infant and maternal welfare are being discussed.

Calcium. Though we were exhorted to add calcium carbonate to flour, as is done in Britain, we felt that the use of milk and cheese to supply requirements was a better aim.

Vitamins. The intake of three of these has had to be brought up to standard by special measures; two of them, vitamins C and D will be given in outline under the heading of infant welfare.

It is appropriate to refer here to *vitamins of the B group*.

Vitamin B₁: Countries such as Britain and United States of America have adopted policies of adding synthetic vitamins ("token nutrients") to flour. In former years, Britain had used higher extraction flour. We were guided by two considerations in choosing the latter method: the economics on the one hand, and the view (appropriate to disciples of J. C. Drummond) that one did not know whether the "token" nutrients would leave out something still unexplored. The economic argument is the more permanent one when it comes to political dealings! As to riboflavin and "niacin equivalent", there is enough milk available, it is subsidised, and the people can purchase it if they understand its value. There is no shortage of meat, and people are all in the habit of using it—

any exceptions are very few in number. Some orientation towards the use of liver and other organ meats needed to be encouraged, and there has been reasonable response to this teaching. There are no confirmed reports of riboflavin and niacin deficiency except in the case of alcoholics, but their problem is largely a social one, to be met in other ways.

The institution of higher extraction flour occurred initially in response to the emergency of the world shortage of food in 1946. The history has been amply covered in an article by the writer (see *J. Home Science Alumnae* 20, 33-38, 1951). We had already a higher thiamine content in our white flour than prevailed in Britain or the American continent—our white flour had an average of 1.6 micrograms of thiamine per gram prior to raising the extraction rate. The realistic approach took into account the preference of about 95 per cent. for white bread rather than wholemeal. One telling factor in this choice, at any rate during the week-end, is that the five-day week necessitates buying on Friday all the bread needed until Monday morning. White bread does not stale as readily.

New Zealand was caught up in the advertising campaign which implied that additional vitamins added zest to the person who took them. The free pharmaceutical benefits suffered a considerable drain through prescriptions of vitamins. In the circumstances, it seemed advisable to plan for increasing the extraction rate, and it can be said that this measure has halted the widespread tendency there was to regard white bread as a food deficient in nutrient materials, and it has allayed fears about vitamin deficiency. From the economic angle, it has reduced the amount of subsidy that the Government has had to pay, and also has obviated the need to import vitamins for adding to flour. The public purse has stood to benefit in consequence, by an amount estimated at about £250,000 a year.

It was through an alteration in the milling technique that this was achieved. The present Director of the Wheat Research Institute (E. W. Hullett) planned to select the scutellum for further treatment in the mill. The "streams" of flour, about 18 in number, were studied to find which had the highest content of thiamine. Then, a machine was devised which detached, through friction of the particles when the machine was revolving at high speed, a greater amount of flour from those thiamine-rich particles. A sum of money was granted by the Minister of Health for a large-scale trial in a commercial mill before it could be expected that the millers would agree to install the machinery. In the early part of 1946, the Council of UNRRA appealed to all countries to raise the extraction rate for flour, an appeal to which the New Zealand Government responded by compulsorily raising the extraction rate to 80 per cent. Payment to the millers then became based on their getting

80 per cent. of the wheat returned as flour—they get more money for flour than they do for pollard or bran, weight for weight.

Prior to 1946, no improver had been permitted; but ascorbic acid was legalised in 1947. Subsequently, bromate was permitted as an improver.

A hopeful development has been the breeding of better types of wheat, under the direction first of the late Dr. Hilgendorf, and later of Dr. Frankel, who has however now gone to Australia. The use first of "Cross Seven", and later of Hilgendorf, and subsequent varieties has enabled us to be more nearly self-supporting, depending less on imported wheats.

The target set by the British Conference on the Post War Loaf, namely to have flour containing not less than 2.4 micrograms of thiamine per gram, was more than achieved by our 80 per cent. flour, which contained on the average 3 mcg/g. Later, the bakers asked for a reduction of extraction rate to 78 per cent., and though there is no longer any compulsion to maintain a given rate of extraction, the payment is made on the basis of obtaining 78% of the wheat in the form of flour. At present the thiamine stands at about 2.4 mcg/g.

The colour of the loaf is just off-white, and the flavour is very acceptable.

There is a move afoot to introduce the new continuous bread-making process, as opposed to the batch process at present in use. If a suitable substitute for the iodate can be found, this new process will mechanise bread-making to an even greater extent than at present, and will eliminate some of the difficulties which accompany the application of our labour laws.

Milk. In 1943 there had been so many complaints about poor quality and serious shortages of milk that a Milk Commission was appointed, as a result of whose recommendations legislation embodied in the Milk Act, 1944, provided for a Central Milk Council to resolve these difficulties. Local Milk Authorities control the affairs of Milk Districts. The Central Milk Council has evolved into the New Zealand Milk Board, under whose jurisdiction the marketing of milk is now carried out. Town Milk Producers are organised into groups, who arrange how the "nominated quantity" for all-the-year-round, even supplies is to be allotted to its members. More is paid for milk in winter-time than in summer. There are also payments for bacteriological quality. Milk vendors are allotted a zone by their local authority. Producers, vendors, as well as consumers are represented on the New Zealand Milk Board. It is now becoming the accepted practice to have milk delivery vehicles covered from the sun's rays, to prevent the development of off-flavours, and loss in vitamin value. Many of the milk treatment plants were obsolete, but most have been replaced by up-to-date HTST pasteurising machinery; bottle-washers of good type; de-

crating and re-crating machinery; farm-chillers and tanker pick-up are recent developments. Pasteurised milk is now accepted by the majority of consumers in towns.

The standards required by the New Zealand Food and Drugs Regulations are:

Fat (minimum percentage), 3.25% (School milk is however allowed to be lower).

Solids-not-fat (minimum percentage), 8.5%.

Reductase test positive in not less than 4 hours (most of it goes to 6 hours+)

The addition to or subtraction from the constituents of milk is illegal.

The average fat content is 4.1 per cent.

The average amount planned for in the nominated quantity is virtually 0.8 pint per person per day. (A full account has been recorded by M. E. Bell in *J.H.Sci. Alumnae*, 23, 1954, 32-45).

Whether the People can Procure the Food

According to United Nations statistics New Zealand has the fourth highest income per head in the world. The income is fairly evenly distributed; 27 per cent. have an income of less than £600, and only 4.5 per cent. over £2,000 per annum.

Price control of bread and flour has existed since 1914-1915. From 1939 a Price Tribunal, also latterly a Prices and Practices Stabilization Committee has deliberated before allowing any price rises of commodities.

Consumer Subsidies

During the war and post-war period the Government implemented a policy of stabilising internal prices at the level of those prevailing in December, 1942. For the effective operation of this policy a system of Government subsidies was essential. The total amount paid out in subsidies for dairy produce (butter and milk) for 1959 was £7,971,000, of which the subsidy on milk accounted for £3,446,931. For wheat and flour it amounted to £4,500,000. Put into terms of what the consumer pays and the additional amount paid by the Government in subsidy:

	Retail Price to Consumer		Subsidy	
	s.	d.	s.	d.
Bread per 2 lb. loaf	0	7½	0	3
Flour per 25 lb. bag	6	5	4	11
Butter per lb.	2	0	0	8
Milk per Imperial pint	0	5	0	1¾
Eggs per dozen (variable prices) ..	(5	0)	0	4

There was formerly a subsidy on sugar but it was removed in 1948.

Social Security Developments

All groups that are at a disadvantage—the aged, children, widows, orphans, the blind, invalids, the sick, the disabled—receive benefits under the Social Security Scheme.

Old age pensions were first instituted in 1898 by the Seddon Government. Over the years there has been an extension to include disabled miners, widows, the blind (in 1924) and so on. Most of these benefits were conferred from 1938 to 1939 (following the economic depression of 1930-1935 in which pensions were reduced by 10 per cent., and the unemployment peak of 79,435 was reached in 1933).

A full account of these events in the history of measures aimed at caring for the less fortunate members of the community is given in "The Growth and Development of Social Security in New Zealand" (Government Printer, Wellington, 178 pages, 6s., 1950). An invalidity pension came into being in 1936 and that year also saw substantial improvement in old age and widows' pensions. The Social Security Act of 1938 provided for invalidity, sickness, disability, widowed mothers, orphans, and for State superannuation. It was financed by a contribution from all, of 1s. (later raised to 1/6) per 20/- wage or salary.

Medical Benefits

Maternity benefits introduced in 1939 were closely followed by health benefits, hospital and pharmaceutical benefits. The fear of want or of difficulty of paying doctors' or hospital fees had been eliminated.

A *State marketing scheme* was also brought into operation. Though it has nominally been taken over by Boards established for each food commodity marketed, it has been little more than a partial transference of activity. The Board controlling marketing of milk, for example, has to take the subsidy into consideration, and cannot make any radical changes in price without ministerial consent.

Food prices were very low during the depression years but in spite of these low prices, incomes at a reduced level meant that people had to plan their spending much more carefully. At that time the School of Home Science helped by publishing low cost menus under the title "Adequate Low Cost Dietaries" (author: Elizabeth C. G. Wilson, N.Z. J. Sci. & Technol., 20, 134-160B, 1938). In 1939 a booklet incorporating optimum and low-cost menus, along with information about foods was published by the Department of Health at the instigation of the newly formed Medical Research Council (Good Nutrition—Principles and Menus, E. Gregory and E. C. G. Wilson. Ed. M.E. Bell). In 1939 studies were begun on the foods consumed by Basic Wage Earners. These studies will be referred to later.

Care of the Aged

The high proportion of citizens in the older age group has called for the establishment of Welfare Councils. These supervise all aspects connected with the care of the aged, many of whom live in homes for the aged where their meals are provided. The homes are usually built by religious bodies or by local authorities, towards which the Government contributes subsidies.

Meals on Wheels for old people. There are 16 or more separate schemes in operation by which about 700 old people living alone are provided with a hot meal each day distributed by voluntary helpers. The meal consists of meat, potatoes, vegetables and a sweet course, enclosed in special containers designed to keep the meals hot till their arrival. Each case is considered before being admitted to the scheme and only those who are suffering from disabilities and whose relatives cannot help them are served by the scheme.

Care of Crippled Children is covered by a special fund and a special home with helpers selected and trained for the purpose of helping in the education, feeding and rehabilitation of children disabled by spastic paralysis, poliomyelitis or other neuromuscular disorders.

Feeding of Hospital Patients

In the 1920's, the management of the food services in hospitals left much to be desired. An investigation by E. A. Pope carried out under the aegis of Victoria University of Wellington in 1926 showed that there was a very great need for improvement.

The subject has been outlined by E. Gregory in "The Development of Dietetics in New Zealand" in "Nutrition" 6 (4), 22-24, 1952.

Prior to 1940, there was very little progress in administration of hospital diet departments. A succession of Home Science graduates went overseas for training in hospitals in Britain or in U.S.A. or in Australia, but few were made use of by hospital boards.

Following a meeting between Health Department and Home Science Faculty representatives held in November, 1940, with the objective of outlining a course for a diploma in dietetics to be given by the Department of Health, a tentative syllabus was drawn up. Students were accepted for training in the four main hospitals; Dunedin Hospital being reserved for the course to be taken by qualified nurse candidates.

In 1942, Miss Catherine Macgibbon, Lecturer in Foods of the Home Science School, was asked to survey facilities in the four hospitals where students had begun to take the course. This formed the basis for recommendations to the respective Hospital Boards.

Since that time, 225 students have qualified. The New Zealand Diploma in Dietetics may be taken by the holder of either the B.H.Sc. or the Diploma in Home Science of Otago University, or equivalent qualifications, or by registered nurses. The training is divided into three main subjects—administration of the diet department, general catering, normal nutrition and diet therapy. The student also has to be able to give a short course to nurses. A minimum period of 44 weeks is spent in practical work in various sections of the Training School and 4 weeks in subsidiary hospitals. Student dietitians are paid during their hospital training. A number of bursaries are granted each year to those who wish to do the prerequisite University training in the Home Science School.

Since the advent of dietitians into hospital kitchens, cookery methods and the standard of hospital equipment have greatly improved. The Health Department appointed a dietitian specifically for the purpose of helping with the planning of hospital kitchens and of keeping a register of qualified dietitians so that assistance could be given to Hospital Boards in making appointments to fill vacancies.

A Dietitians' Association was formed by those holding the necessary qualifications. It held its first conference in 1943 and published its first (cyclostyled) Bulletin in 1946. This helpful publication was in later years printed twice a year as "The New Zealand Dietetic Journal".

In 1950, the Association was successful in obtaining legislation, *viz.*, "The Dietitians' Act", requiring the registration of dietitians by a Dietitians' Board. Only those who have had the requisite training (or its equivalent) are legally permitted to register, and the use of the term "dietitian" is unlawful for anyone whose registration is not permitted by the Dietitians' Board. A panel of examiners is appointed by the Board, which determines the conditions of training, and decides on the merits of applicants from abroad, or the further training that these applicants must undergo before being accepted either as candidates for examination or as registered dietitians.

Each year, a conference, occasionally replaced by a refresher course, is held and is always well attended and valuable.

The Feeding of Infants. Since 1907, the feeding and care of infants has been the special concern of a voluntary welfare system founded by the late Sir Truby King, usually referred to briefly as the "Plunket Society", though its full title is "The Royal New Zealand Society for the Health of Women and Children". Mothers have increasingly drawn on the nursing services which the Plunket Society offers for the purpose of health promotion, as the following figures show:

<i>Year</i>	<i>Number of Branches</i>	<i>Number of Nurses (District)</i>	<i>Percentage of babies under supervision in New Zealand</i>
1907	1	1	not known
1914	20	27	not known
1920	30	46	20 per cent.
1925	55	95	50 " "
1930	70	127	67 " "
1935	68	125	71.5 " "
1940	70	138	77.96 " "
1945	73	152	81.33 " "
1950	89	190	86.09 " "
1955	97	203	87.8 " "
1958	101	215	88.6 " "

Dr. Truby King was appalled to note that of the 25,000 babies born each year at that time, about 2,000 died within a year of birth. He expressed his belief that half of these deaths were preventible. He took into his own home a number of babies suffering from malnutrition resulting from mismanagement, and in a short time proved that, given suitable food and good management, the babies thrived. Sir Truby came first to understand animal feeding, through being responsible for the management of a large farming estate attached to the mental institution of which he was medical superintendent; consequently he was a formidable competitor at agricultural shows. By 1921, he had already been asked to advise on nutrition in post-war Europe; while, in New Zealand, he was appointed as Director of Child Welfare. The Plunket Society's work was the subject of review in 1959, the Report of the Consultative Committee on Infant and Pre-School Health Services refers to the unique position the Society holds in the esteem of the community. "The Plunket Nurse in whose district a baby is born has notice of the birth sent her by the local Registrar of Births. The nurse then communicates with the mother and *offers* her services, which commence with the discharge of the mother and baby from the maternity home. Babies are visited weekly in their homes until they are settled. More frequent visits are paid if required. After the weekly visits terminate the Plunket Nurse calls each second week until the baby is brought to the Plunket rooms for a check-up at the age of three months. After the age of three months further appointments are made for examination at gradually lengthening intervals, until the baby attains the age of 18 months; then, having passed through infancy, it is deemed to be a pre-school child. The society seeks to examine healthy children yearly at the Plunket rooms. Whenever possible, it arranges for two examinations to be made by a medical officer of the Department of Health—at two years and at five years of age." "New mothers are brought under its influence by a widespread knowledge of the nature and quality of its work and by its popularity." "The Plunket nurses examine

about one-half of the children between 18 months and five years of age. They invoke medical aid if that seems needed. Mothers are not predisposed to take well children for examination.

Already by 1920 the infant mortality rate had been reduced to what was at that time the lowest in the world. The accompanying graphs show the dramatic improvement there has been in all coun-

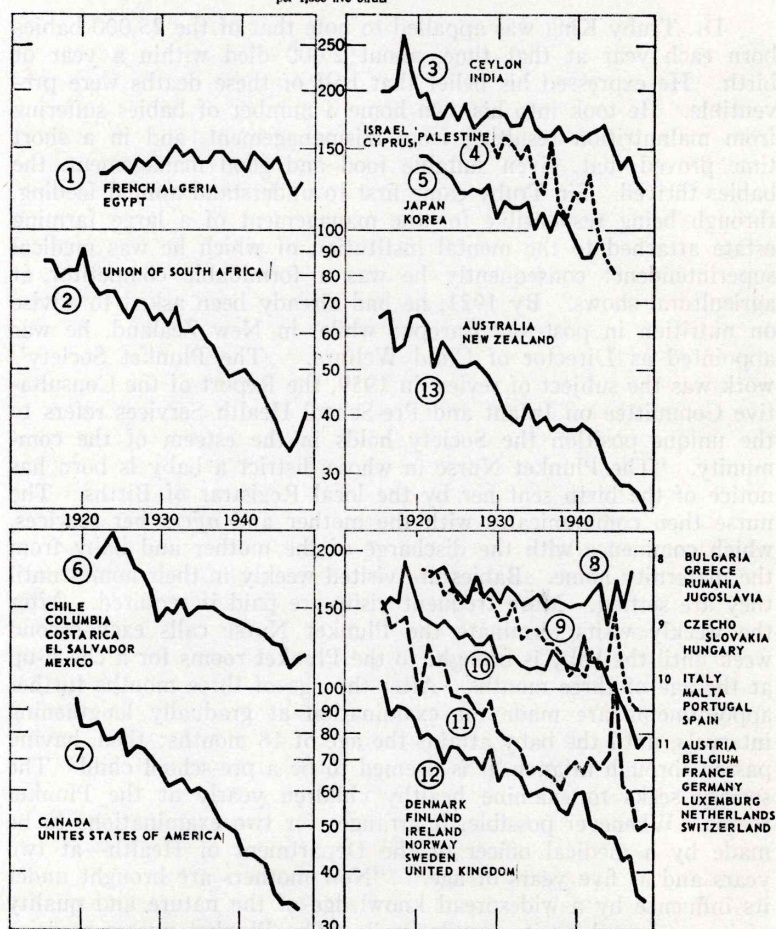
TRENDS IN INFANT MORTALITY, 1915-1949

Deaths under 1 year per 1,000 live births.

United Nations Population Studies, No. 13. 1954.

TRENDS IN INFANT MORTALITY, 1915-1949

Deaths under 1 year
per 1,000 live births



tries over the last 40 years. According to United Nations Population Studies, New Zealand and Australia have the lowest figures per 1,000 live births, with New Zealand in a slightly more favourable position. This reduction was due in part to better feeding, in part to the fact that whereas previously infants had been confined indoors, they now took their exercise in the fresh air and sunshine. In the last two decades there have been superadded the techniques that circumvent Rh incompatibility, infection, and so on. It is the purpose of this review to deal solely with the nutritional progress of the last four decades in so far as it has contributed to reduction in the death-rate of infants.

More precise figures for infant mortality among European infants for 1958 are 19.40 per 1,000 live births. The subject of Maori infants will be explained later; it is only in urban areas where the Maori mother sometimes avails herself of help from the Plunket system.

Breast-feeding is encouraged, but where it is unsuccessful, it is imperative that the milk used in artificial feeding should be bacteriologically safe. The techniques of preparing the formula from liquid milk or from dried or evaporated milk are demonstrated in parent-hood classes, or shown to the individual mother. The recipes for artificial feeding of infants have been available in books sponsored by the Plunket Society: the first edition of "Feeding and Care of Baby" was printed in 1910 under the authorship of F. Truby King; several other books and pamphlets were published by the same author. The most recent handbook sponsored by the Plunket Society is "Modern Mothercraft", which appeared in 1945 (Authors: Helen Deem and Nora P. Fitzgibbon).

It is pertinent to outline the type of training which is required of the nurses for this work, *viz.*, Plunket nurses and Karitane nurses. (Pronounced Kar-it-ah-nee). The Plunket nurse has received her nursing certificate following her course in a general hospital; then done 6 months' training in midwifery, and a 4 months' intensive course in infant and pre-school welfare at the Society's Training Centre. She has selected this avocation because she is emotionally suited for dealing with children. The Plunket nurse is qualified to take a position in charge of a children's ward; or she may be made responsible for the health supervision of the European infants and pre-school children in her area, and for health teaching on all matters pertaining to the family unit. She visits the homes, or sees the infants brought by the mothers to the Plunket rooms; likewise the pre-school children are seen by her, and she also is in attendance when the medical officers examine the children. She takes an active part in Mothers' Clubs and in Mothercraft or Fathercraft classes. Care of the breasts is part of the instruction given in antenatal clinics. The mother is taught the art of hand-expression to clear the mammary ducts prior to parturition. If needed (for inverted

nipples) plastic shells may be advised. The mother is given a plan for a nutritious diet during pregnancy and lactation, and advised about the value of exercise, fresh air and sunshine.

Responsible young parents are anxious to learn correct methods. Fathers build the Plunket rooms during their free time; fathers and mothers take part in efforts to raise money for supporting their local branch of the Society. Study and discussion groups are organised by the Mothers' Clubs.

The fact that the Plunket Society is built round this type of community effort, where mothers and fathers can pass on information to one another, is an important aspect of education in parent-craft. A prospective parent is prepared to accept the advice of a parent of the same age group who can pass on recent experiences. A touch of rivalry when mothers attend the clinic adds to the receptive attitude.

Karitane nurses, 150 of whom qualify each year, but of whom the demand always exceeds the supply, begin at a minimum age of 17, have had a good secondary school education, do a total of 20 months' training, 16 months being spent in a Karitane Hospital, 4 months in practical experience in the homes of suitable families under the eye of the local Karitane Nurses' Bureau. The Karitane nurse is employed by a family to care for the baby when the mother comes out of the maternity home and when, for some reason or other, she is unequal to deal with her manifold duties in the home. It must be explained that help in the home is a rarity in New Zealand.

Karitane Hospitals are supervised by paediatricians, specially selected for their skill in children's work. The Karitane Hospitals perform the dual function of caring for mothers and babies and training Plunket and Karitane nurses. The trainees provide the essential nursing services for the hospitals and at the same time learn the principles of infant care. The care of premature infants is one of the main functions of these hospitals. Of 2,768 prematures admitted in the last five-year period, there have been only 29 deaths; this is in contrast with the total 12,120 prematures born in the same five-year period, of whom 1,760 died. Malnutrition and failure to thrive are causes of many admissions to the Karitane Hospitals. Mother and babe are both admitted when there is some special difficulty and then only if treatment under home conditions would be inadequate. The trainees are usually unpaid while training.

The evolution of the feeding schedules for infants and of the advice given to expectant and nursing mothers has been the subject of a paper (Review of Nutritional Trends in New Zealand, 1925-1950: Muriel E. Bell, N.Z. Dental J., 48, 174-182, 1952). This evolution was common to most regimes for feeding infants during the period under review. The formulae were finally simplified and approved by the Paediatric Society; they were published in the New

Zealand Medical Journal, 51, 118-119, 1952, by Helen Deem—title: A Revised System of Feeding Adopted by the Plunket Society. In 1957, Helen Mackay outlined the progress and changes in the two decades between 1936-1957 (Nutrition XI, 158-164, 1957). Similar changes were occurring at the same time in the regimes for feeding infants in New Zealand. A brief summary follows:

(i) *Underfeeding* was the subject of criticism by the eminent paediatrician, M. B. Spencer (N.Z. Med. J., 36, 1937, 4-20; 37, 115-136). Spencer nevertheless gave credit to the Plunket Society for the value of their general care. This state of affairs was remedied in 1938 when the Medical Advisory Committee of the Plunket Society recommended an immediate increase in the protein content of the milk mixture, and the commencement of mixed feeding at 6 months; it had previously begun at 9 months, and was then cereal only.

(ii) The newly formed Medical Research Council received a letter from the British Medical Association, N.Z. Branch, recommending an enquiry into infant nutrition. The Nutrition Research Committee, under the chairmanship of Prof. J. Malcolm, met the Plunket Society Executive, and as a result the two bodies decided to appoint Dr. W. E. Henley as Lady King Scholar for 1939-1940. His report, "A Survey of the Clinical and Nutritional Status of 1,076 Infants Aged 6 Months" (mimeographed only) comprised clinical studies of 1,000 full-term and 76 premature infants. A few were markedly underweight, a few showed signs of healed rickets by X-ray, a few had anaemia, the proportion being greater among the premature group. The premature infant is more liable to anaemia and rickets because it is handicapped by having had less time in utero to acquire a store of iron, calcium, magnesium and phosphate from its mother; during the last four weeks the full-term infant practically doubles its store of minerals as had been summarised in the review by Garry and Stiven in 1936 (Nutr. Abst. Revs.).

In 1939, Dr. Helen Deem was appointed as Medical Adviser to the Plunket Society. The Nutrition Research Department had been set up at about the same time; M. E. Bell was appointed in 1940 to the dual position of Nutritionist to the Department of Health, coupled with the honorary task of being research officer to the Nutrition Committee. In the Home Science School, the appointment of Professor Elizabeth Gregory, whose special subject was nutrition, as Dean of the Home Science School, provided another front for advance in basic knowledge. Co-operation in research and the use of the nursing services to gather from as well as to spread information to the mothers brought rapid achievement.

The augmentation of the allowances of calories and protein from 1938 onwards meant new criteria for weight gains. Records

were collected from all over the dominion. The 1942-43 Annual Report of the Plunket Society refers to the *survey of 8,984 healthy infants*; these were treated statistically to form the basis of the *growth zone* chart published in 1943 to replace the former average weight curve. Its use has not only given better guidance to nurses as to the progress of the child, but it has also relieved the minds of many mothers whose infants were of smaller body build.

Anaemia: In 1940, Deem reported the result of her *haemoglobin survey of premature infants*: 43.5% were anaemic; the lower the birth-weight, the more liable the infant was to develop anaemia. Breast-fed babies seemed to have an advantage. From 1940, *medicinal iron* was given to premature infants. When free pharmaceutical benefits became available, she arranged for all infants to receive "repeat" prescriptions for iron on the grounds of "nutritional anaemia"; the "repeat" provision made it easier for the mother to continue the preventive treatment throughout the first year of life.

Prevention of Rickets: The vitamin D content of Plunket emulsion (Kariol) was increased from 750 to 1,050 units per ounce, in 1940. Commercial firms making malt and cod liver oil accepted advice and raised the vitamin D content from 90 to 570 units per ounce. Also in 1940-41, shipping losses had cut down our supplies of cod liver oil to almost vanishing point; so we applied knowledge gained through researches on the vitamin contents of oils from New Zealand fishes; consequently a New Zealand industry was established. The Nutrition Research Department has continued to examine proprietary preparations, and has kept up standards for imported products by appraising firms of shortcomings in products offered for sale.

Advice from this department also led to physical improvement in the Plunket emulsion.

Assertions that rickets frequently occurred in New Zealand infants had to be checked: (a) in microscope sections of bones obtained from post-mortems, J. Malcolm (N.Z. Med. J. 45, 428-433, 1946) showed that children in New Zealand were in better case than those reported on by E. A. Park and co-workers at Johns Hopkins (Follis, Jackson, Eliot & Park, Amer. J. Dis. Child. 66, 1943, 1-11. Using the histological method, Malcolm found slight derangement of the architecture of the bone in a proportion of the under two-year-olds; a little persisted until 4 years; but as the study had been done on children who had been ill in hospital, we sought evidence from living children; (b) a collaborative study (Deem, Buchler & Weeber, unpublished) on 105 infants gathered in by nurses because of alleged stigmata of rickets, and submitted to clinical, radiological and phosphatase examinations in 1944 revealed no evidence of rickets. On the other hand, Deem found six pre-

mature infants with rickets in her survey of 207 prem's. in 1940, a finding that was met by the provision of vitamin D from the 2nd week onwards. This was stressed for the breast-fed infant also.

Vitamin C. Medical students doing theses for their training in preventive medicine sometimes choose a nutritional topic. One such was that of V. T. Pearse, who in 1939 applied the dye test to the study of milks fed to infants at Karitane Hospital, Dunedin. Two breast-fed infants were receiving on the average 30 milligrams of vitamin C through their mothers' milk. Artificially fed infants were by contrast short-supplied. Extracts from the 1924 instructions run as follows: "In all cases of artificial feeding give a little fresh fruit juice daily to infants from 3 to 4 months old onwards. . . . Orange juice is best, but the juice of lemons, apples or grapes. . . . or the juice of raw carrot or potato may be used." . . . "The use of fruit juice may be begun at any time after the first month, starting with 10 drops daily increasing at first by a drop or two a day, and later by $\frac{1}{2}$ to 1 teaspoonful or more a month. At a year old a child may have a tablespoonful twice a day." Pearse found that orange juice was contributing 3.4 milligrams of vitamin C daily to artificially fed infants 2 to 3 months of age, 6.8 mg. daily at 5 months, and 20.4 mg. daily at 10 months; the carrot juice contributed the exiguous amount of 1.1 mg. daily to a $7\frac{1}{2}$ months old baby.

It should be pointed out that even the League of Nations Committee on Nutrition published recommendations in 1937 which within a year or two were superseded, such was the rate of nutritional progress at that time.

Apart from the low levels of supplementation through orange juice, there was delay in the introduction of green vegetables and potato in the 1924-1930 era "In the second year, potato and gravy may come to form part of the midday meal, but only a small part". Vegetable puree and fruit pulp were introduced at the 6th month in 1939, latterly at the 5th month.

During World War II, oranges became unobtainable. Research had just been in train to find out the vitamin C values of New Zealand fruits and vegetables (Barbara Johns: *The Ascorbic Acid Content of Some New Zealand Products*, N.Z.J. Sci. & Tech., 27, (2A), 188-197, 1945). Recipes for rose hip syrup were immediately devised and circulated by all the nurses, who encouraged mothers to make their own until commercial production could be started. Initial troubles with the manufacture of it stemmed from shortage of suitable equipment—it had to be imported, and a priority secured; meantime we circulated recipes for other substitutes for orange juice; some were applicable to the north, others had to be devised for the south, such as to cover all seasons of the year. Shipping at the time was a difficulty, between the two islands as well as from overseas. However, our efforts were rewarded by an absence

of infantile scurvy. It should be further noted that tin was scarce, and tomato juice was precluded, except where preserving jars could be begged—for glass was also unobtainable.

The attitude to meat and eggs deserves comment. The absence of meat until the 15th month, when a little chicken, light fish, or underdone beef or mutton was to be given occasionally, and 2 or 3 eggs were permitted weekly from 18 months on, left the protein and iron intake in arrears, compared with the new regime, in which egg yolk or liver juice or meat juice is given at 6 months, coddled egg at 12 months.

Maori Infants. Different cultural backgrounds have put the Maori infant at a considerable disadvantage in some respects. The present author has seen the time when Maoris refused to come to a hospital for treatment, because of the association between hospitals and death! The scene has changed markedly of late. Young Maori mothers are losing the reluctance their forbears showed in attending antenatal clinics, or in implementing the advice given them. Those of us who feel great concern at the contrasting high figures for infant mortality can feel a little satisfaction to note that there has at any rate been a marked fall of recent years. Public Health Nurses of the Department of Health have gained a footing, but as the recent Report of the Consultative Committee on the Infant and Pre-School Services states, the Department of Maori Affairs when consulted made no suggestion of the desirability of any change. In 1938, when European infant mortality stood at 35.63, the Maori race lost 153 per 1,000 live births. It had dropped to 73 in 1950, and 54.37 in 1958.

The present author's speculation has been, over a number of years, that as the Maori mother produces twice as many children as the European, she and her later infants are likely to have less iron stored for preventing anaemia in the infant. To test this hypothesis, Dr. Shirley Tonkin has been studying the infants born in Auckland; according to a preliminary paper she gave at the Paediatric Society's Conference in 1959, there is a lesser average in the Maori than in the European at birth. She is trying to encourage expectant Maori women to take iron medicine during pregnancy. Agreement to do so is always most affable, but it will probably take a while before one of their own race can convince them that it is anything more than a Pakeha whim! So far, the bottle tends to remain unopened. Doctors who work among Maori children state that there is a great deal of middle ear disease; as Dr. Helen Mackay pointed out in the '30's, there is an association between anaemia and respiratory and alimentary infections. The Board of Health now has a Committee on Deafness, and it has this matter in hand. The tendency to infections is greater when the custom of sharing one room among all the family has not been

abandoned. None of the foregoing is said in criticism—they are a sensitive race, and sometimes shyness is a barrier to health promotion.

FIG. 3

BREAST FEEDING IN NEW ZEALAND—1938-1952

Helen M. Deem—Annual Report of the Plunket Society, 1952-53

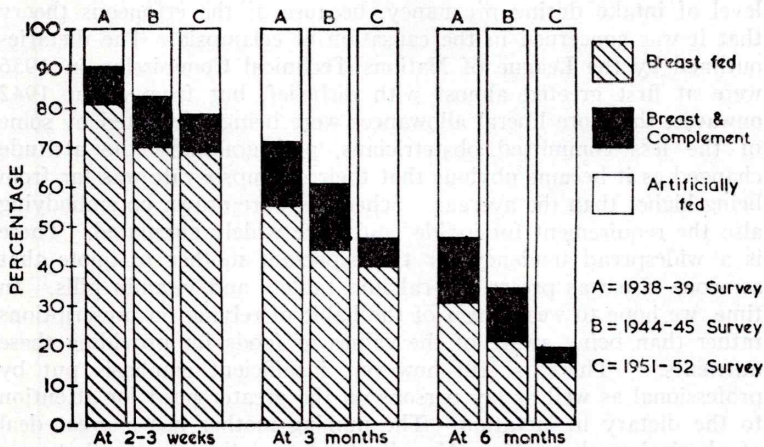


FIG. 1.—Breast-feeding in New Zealand: A summary of the results of the Plunket Society's surveys of 1938-39, 1944-45 and 1951-52.

Breast Feeding. In her survey of premature infants (in 1940) Deem found a somewhat better nutritional status in the infants at 6 months when they had been breastfed. She made three surveys on the extent of breast feeding, 9,000 cases, 7,700, and 12,000 cases being studied (Annual Report of the Plunket Society, 1952-53, 21-29). Fig. 3 taken from that report illustrates graphically the progressive decline from 1939 to 1952, when for example 15 per cent. fewer were continuing to breast-feed into the sixth month, than in 1939. This is a big reduction in little over a decade.

An analysis of the reasons for weaning was made; failure of supply completely eclipsed all other reasons. All groups were represented, wives of professional, artisan and unskilled, but the trend was downwards in each. Deem and McGeorge did a further survey; the results are embodied in two papers in the N.Z. Med. J. 57, 539-556, 1958; 59, 31-41, 1960. The latter author analysed the results following the untimely death of the former.

It should be added that Whittlestone made important contributions to the knowledge of factors governing the "let-down"

hormone while he was at the Department of Agriculture's animal research station at Ruakura, Hamilton. Useful summaries on this subject appeared in the New Zealand Veterinary Journal, 5, 1957, 55-60; and in the New Zealand Journal of Agriculture, 78, 1949, 273.

Dietaries in Pregnancy and Lactation

New Zealand was taken in by the fallacious teaching current in the 1920's to the effect that protein should be kept at a low level of intake during pregnancy, because of the erroneous theory that it was concerned in the causation of eclampsia. The dietaries outlined by the League of Nations Technical Commission in 1936 were at first greeted almost with disbelief, but from about 1942 onwards, the more liberal allowances were being advocated by some of the less committed obstetricians, and gradually the attitude changed as it became obvious that their eclampsia rate was far from being higher than the average. Schedules were drawn up embodying also the requirement for iodide, and were widely circulated. There is a widespread tendency for the expectant mother to quote that someone else was prescribed calcium tablets and vitamin pills. In time, we hope to wean them of the habit of relying on prescriptions rather than being aware of the values of foods for providing these nutrients. There is still however, insufficient emphasis put by professional as well as lay persons on the greater need for attention to the dietary in lactation. The nursing mother has a great deal of physical work to do in New Zealand, and the anxiety that goes with the relentless round, coupled with imperfect attention to the extra requirements for food during lactation, may set the stage for termination of milk secretion.

There is a proportion of women who show subnormal levels of haemoglobin during pregnancy. In ante-natal work, some obstetricians adopt the practice of prescribing a course of iron medicine as a routine for a month or more. The use of ascorbic acid along with it has not yet been widely adopted.

C. FOOD HABITS; FOOD LAWS; FOOD TECHNOLOGY; EDUCATION IN NUTRITION; RESEARCH

Dietary Survey data are few, and most of those that have been collected were during the first half of the period under review: Storms and Todhunter, 1928, J. Home Econ. 20, 817-824; Gregory, Todhunter, Thomson & Chambers, 1934, Home Science Department Publication, Otago University, Dunedin; Gregory, Jackson, Chambers & McLaughlin, 1943, N.Z. Med J. 42, 64-70; McLaughlin, 1943, *ibid.* 42, 155-162; McLaughlin & Wilson, 1945, *ibid.* 44, 93-98.

The errors in the average dietary are summarised in Normal Nutrition, Notes for Nurses (Bell).

Food laws are aimed at prevention of harmful effects; no substance is permitted as an additive unless specifically legalised; adulteration is against the law; food handling laws have been scheduled, though practice leaves much to be desired; most town supplies of milk are pasteurised, though there is still a vocal opposition on the part of a few who imagine that some virtue is thereby lost; there are standards (bacteriological) for public water supplies; fluoride is being added to only two of them (as at August, 1960).

Food technology progresses slowly. Refrigeration of meat for export has been in operation for many years. Recent developments in the refrigeration industry have been the blast process, applied to the freezing of meat and of cream; quick frozen vegetable factories now number six; cheese and butter factories abound; milk is dried by the spray and roller processes, full-cream and skim; whey is made into a concentrate or is used for obtaining lactose; one of the uses to which the latter has been put for many years is for making artificial milk mixtures for infant feeding; there are a number of canning factories, for meat, vegetables or fruit. New Zealand scientists developed a process for drying meat but it has had limited uses, and the factory has closed down. Dried meatmeal is a constant byproduct of the meatworks, being used for animal feeding. It was the basis of the dog-food used by the 1929 Byrd Expedition and the New Zealand Transantarctica Expedition of 1957, and of later sledging expeditions by New Zealand scientists (Bell, N.Z. Med. J., 1957, 56, 289-304).

Setting a Nutritional Standard. New Zealand has adopted the tentative standards proposed by recognised authorities, e.g., the League of Nations Technical Commission's standards, and the Recommended Allowances of the Food and Nutrition Board of the U.S.A. National Research Council; and a New Zealand Dietary pattern has been used, with the Recommended Allowances put into terms of New Zealand food preferences, and food availability. We have not been dogmatic about vitamin C—for we can achieve good levels with vegetables and fruits; and until more is known about its functions, we use the tentative recommendations of the Food and Nutrition Board, in the belief that the vegetables and fruits have other properties as well, such as providing a detoxicating mechanism through the presence of pectins, as well as furnishing "smoothage" for bowel action, and also magnesium which is not well represented in other classes of foods. Moreover, a certain amount of anaemia among pregnant women could possibly be lessened by a good intake of vitamin C.

Education in Nutrition

At top level, New Zealand was fortunate in that the late Professor John Malcolm, first Professor of Physiology at the University of Otago Medical School, who had done post-graduate training

under Zuntz, took a special interest in nutrition; even before he came to New Zealand in 1905, he had published several papers about the composition of foods, from the Department of Physiology at Edinburgh. Medical, dentistry and home science students were given early information about vitamins, to quote one example. His advice was sought on many occasions by Truby King. He made the Byrd Expedition possible by remedying the errors in the composition of the dog food carried from U.S.A. The author of the present paper heard in 1918 about the findings of Eijkman, Hopkins, Rubner, Funk and Lusk, and when she became his assistant in 1922, was given human metabolic studies for her M.D. thesis, and later, animal feeding work when white rats became available. His influence was important also to the School of Domestic Science; he was a member of its faculty and in examinations in nutrition always acted as external examiner. When the Department of Scientific and Industrial Research was formed, he was a foundation member of its Council, on which he served for over a decade. He was assiduous in research as well as competent as a teacher. When the Medical Research Council was formed in 1938, he was appointed as Chairman of the Nutrition Committee, a post which he relinquished shortly after his retirement. All its other members had been his pupils. His disciples have since carried the torch.

The School of Domestic Science was established in 1911, as part of the University of Otago. Its degree course occupies 4 years, its diploma 3 years. A few take the degree of Master of Home Science, and as the present Dean, Professor Elizabeth Gregory specialised in nutrition, taking her Ph.D. under Sir Jack Drummond, a considerable number have taken subjects in nutrition for their theses, and have subsequently been appointed to the staff of the Nutrition Research Department, or to the staff of their Alma Mater. The Home Science School has done much to spread information about foods and nutrition, not only through our own land, but also, through the demand for its graduates overseas, Britain, U.S.A., India, Malaya, China, Korea, the Pacific Islands, and elsewhere, have been assisted through its graduates. In New Zealand, home science graduates have been on staffs of girls' secondary schools, adult education departments, correspondence schools, the rural sociology section of the Department of Agriculture, in the Health Department, and in dietetic departments in the hospitals, where they are required to take part in the teaching of nutrition to nurses. On the staff of the Home Science School, there has been a succession of lecturers in nutrition; they include the following: Helen Rawson, Lilian B. Storms, Olga Gloy, Elizabeth Gregory, Neige Todhunter, Airini Pope, Nancy Aslin, Alice M. Copping, Maureen Frengley, Yola Swindells, Marion Robinson, Helen Shaw.

Every four years, refresher courses are held, nutrition being one of the subjects in which those attending are given information

to bring them up to date. Each year a journal is issued by the Association of Home Science Alumnae, in which there are usually several articles dealing with food, nutrition, food service or technology, or reviews of books on these subjects. One of the objects of the Association of Home Science Alumnae is "to improve the conditions of living in the home, the institution and the communityby dealing with problems of diet. . . ." etc.

Education in Nutrition extends also to schools, and to the adult section of the community. The following agencies are active in this field in New Zealand:

The Department of Health, by the contact of its Medical Officers with children and their parents, by radio talks, displays of posters, advertisements in daily and weekly newspapers, a quarterly health magazine, a travelling exhibition, and the preparation of pamphlets for circulation to the public. Advisory visits to school hostels, children's homes, hospital dietary departments; lectures to post-graduate and public health nurses, and to student groups such as training college students and health inspector trainees are also included in the activities of the nutrition personnel of the Department of Health. Through the nurses who repair the teeth of school children, its Dental Division also gives instruction on the dietary needed for caries-prevention.

Home Science teachers in schools, colleges and manual training centres.

Teachers of Hygiene in the four Teachers' Training Colleges. The Adult Education Department, including the Home Science Extension.

The Nurses of the Plunket Society.

The Rural Welfare Section of the Department of Agriculture.

Much patience is required in this type of work. Recently, it was shown by Judith M. King, in A Sociological Survey of the Home-maker in a New Zealand Community (J. Assoc. H.Sc. Alumnae, 28, 1959, 35-52) that of 70 women chosen at random—every tenth in the directory—interviewed by the personal method, 20 women had no knowledge of the service available to them through the Home Science Extension, 46 had received limited information about the work, and four were well-informed. (The enquiry was made by a staff member of the Home Science extension). It should be stated that education has been free and compulsory during the lifetime of all those interviewed. During the last two decades it has been given on a free, compulsory basis, to all up to the age of 15 years. Many of the women did their preserving by methods advised for out-of date equipment, and in consequence some of their jars were

imperfectly sealed, so that there were losses through the growth of moulds, etc.

Research in Nutrition

As already mentioned, Prof. J. Malcolm pioneered in studies of nutrition in New Zealand. The work of Sir Charles Hercus and colleagues on the incidence and prevention of goitre has already been referred to, as have also the studies by the staff and graduate students of the School of Home Science. Likewise, the data collected by Deem regarding weight gains in infants, incidence of anaemia and rickets in premature infants, causes of decline in breast feeding; also those of Henley. Reference has been made, as well, to the work of various research institutes, such as the Wheat Research Institute, Dairy Research Institute, the various Agricultural Institutes where research on food or on animals is carried out. Mention should also be made of the early work of the privately endowed Cawthron Institute, with its numerous contributions, on soil deficiencies, insect control, diseases of tomatoes, vitamin C content of apples, and so on.

Financial grants to Universities became more liberal at the end of the 1930's; when Hon. Peter Fraser had the portfolio of both Education and Health, the Medical Research Council was instituted, with two of its *ad hoc* committees charged with the responsibility of investigating respectively the problems of nutrition and of diseases of the thyroid gland. The findings of both these committees have paid dividends in terms of health, and in economic advantages as well.

In conclusion, it should be stated that limitation on the length of this history has required that it should be no more than a summarised sketch. It is however hoped that an expanded account of the work of the Nutrition Research Department will be written at a later date.



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